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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR

Malaysia France Institute

FINAL EXAMINATION

JULY 2010 SESSION

SUBJECT CODE	:	FLB30502
SUBJECT TITLE	:	DIGITAL SIGNAL PROCESSING
LEVEL	:	BACHELOR
DURATION	:	9.00am – 11.00am (2 HOURS)
DATE / TIME	:	19 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) question only.
6. Answer all questions in English.

THERE ARE 5 PRINTED PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

(a) Explain with the aid of waveform diagrams, the differences between energy signal and power signal.

(4 marks)

(b) List four (4) advantages of digital signal processing compared to analogue signal processing.

(8 marks)

(c) An independent variable signal of y = x(t) is shown in Figure 1. Considering the time scale operation on continuous signal, draw the following signal:

i. y(t) = x(2t)

ii. y(t) = x(0.5t)

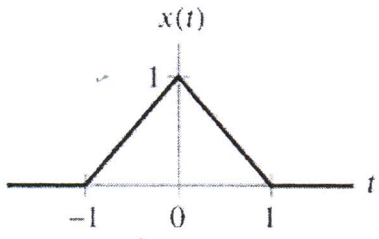

Figure 1

(8 marks)

Question 2

(a) List three (3) approaches that can be used in the construction of digital filters.

(3 marks)

(b) List four (4) advantages of representing a digital signal filter in block diagram form if compared to computational algorithm.

(4 marks)

(c) Define the z-transform method and explain the importance of this method in digital data signal processing.

(5 marks)

(d) Briefly explain the following terms:

i. Recursive digital filter
ii. Non-recursive digital filter
iii. Finite impulse response filter
iv. Infinite impulse response filter

(8 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only TWO questions.

Please use the answer booklet provided.

Question 3

(a) Find the difference equation of the filter shown in Figure 2 and hence list five (5) outputs of the filter given the input is x[n] = { 3, 1, 2 }.

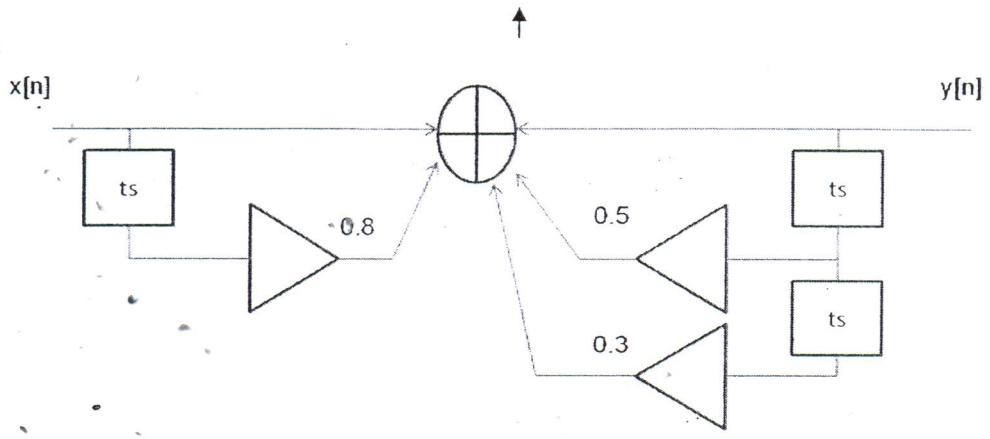

Figure 2

(12 marks)

(b) Using a block diagram representation, design a five-point non-recursive digital filter and express the difference equation of the designed network.

(10 marks)

(c) Draw the block diagram representation of a second order autoregressive moving average (ARMA) filter represented by the following recurrence formula:

$$y[n] = x[n] + 0.9x[n-1] - 0.6y[n-1] - 0.2y[n-2]$$

(8 marks)

Question 4

(a) Define the cross-correlation method and explain the importance of this method in digital signal processing.

(4 marks)

(b) A set of sampled two signals is represented as x[n] and y[n]. Determine the cross-correlation between the signals given the signal sequence as follows:

$x[n] = \{ 2, 1, 4, 3, -2, -3, 2, 4, -1, -3 \}$
$\uparrow$

$y[n] = \{ 3, -1, 2, 1, 4 \}$
$\uparrow$

(8 marks)

(c) Determine the inverse Z-transform for the following filter impulse responses.

i. $X(z) = 3z^{-1} + 5z^{-2} + 2z^{-5} + 8z^{-7}$

ii. $X(z) = 2z^{-1} + 7z^{-3} + 4z^{-5} + 5z^{-6} + 6z^{-7}$

(6 marks)

(d) Using a block diagram representation, convert the Direct Form II realization of digital filter shown in Figure 3 to the Direct Form I realization. Express the Direct Form I realization in terms of difference equation.

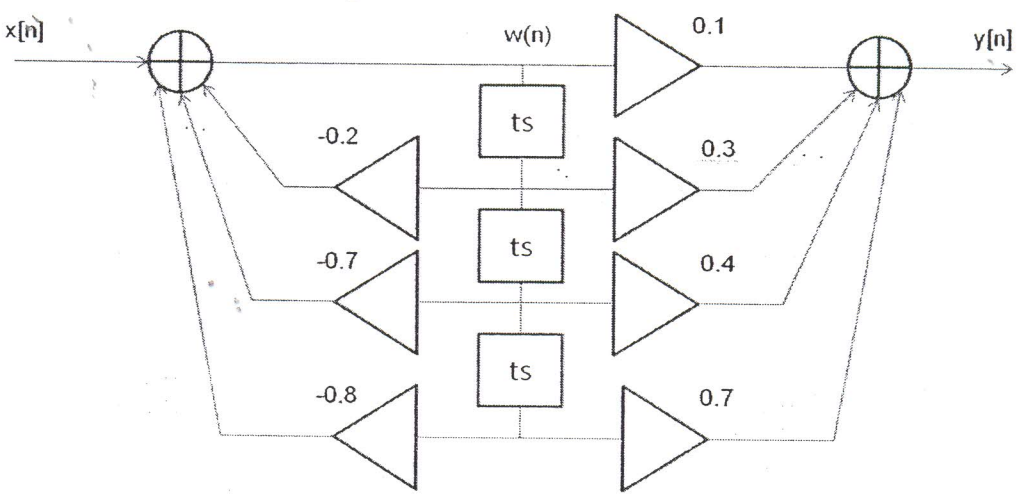

Figure 3

(12 marks)

Question 5

(a) Hardware realization of a digital network is shown in Figure 4. Based on the contents of data memory and coefficient memory presented in Table 1, draw the block diagram representation and express the recurrence formula of the network.

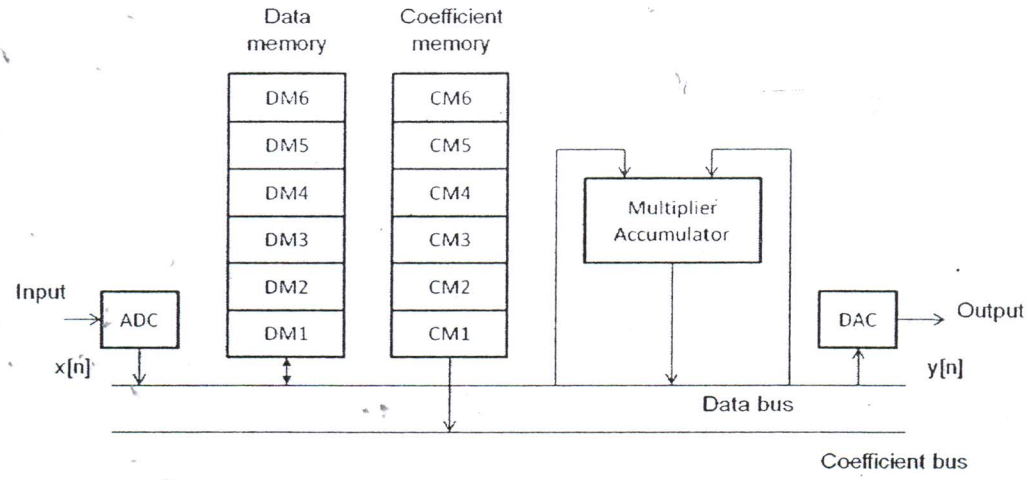

Figure 4

Table 1

DM1	DM2	DM3	DM4	DM5	DM6	CM1	CM2	CM3	CM4	CM5	CM6
x7	x6	x5	y6	y5	y4	0.1	0.2	0.3	-0.1	-0.2	-0.3

(16 marks)

(b) Determine the first four (4) terms of the inverse transform for the following z transfer function.

$$F(z) = \frac{3z + 2}{5z^2 + 4z + 1}$$

(6 marks)

(c) Two signal sequences are expressed as $x_1[n]$ and $x_2[n]$ as follows. Determine the discrete-time-convolution of the signal sequences using the Z transform.

$x_1[n] = \{ \underset{\uparrow}{4}, 2, 5 \}$ and $x_2[n] = \{ \underset{\uparrow}{2}, 1, 3, 6 \}$

(8 marks)

END OF QUESTION PAPER